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Discontinuation of Antiretroviral Therapy Among Adults Receiving HIV Care in the United States

Alison J. Hughes, MPH[*], **Christine L. Mattson, PhD**[†], **Susan Scheer, PhD, MPH**[*], **Linda Beer, PhD**[†], and **Jacek Skarbinski, MD**[†]

[*]San Francisco Department of Public Health, San Francisco, CA

[†]Division of HIV/AIDS Prevention, Center for Disease Control and Prevention, Atlanta, GA

Abstract

Background—Continuous antiretroviral therapy (ART) is important for maintaining viral suppression. This analysis estimates prevalence of and reason for ART discontinuation.

Methods—Three-stage sampling was used to obtain a nationally representative, cross-sectional sample of HIV-infected adults receiving HIV care. Face-to-face interviews and medical record abstractions were collected from June 2009 to May 2010. Data were weighted based on known probabilities of selection and adjusted for nonresponse. Patient characteristics of ART discontinuation, defined as not currently taking ART, stratified by provider-initiated versus non–provider-initiated discontinuation, were examined. Weighted logistic regression models predicted factors associated with ART discontinuation.

Results—Of adults receiving HIV care in the United States who reported ever initiating ART, 5.6% discontinued treatment. Half of those who discontinued treatment reported provider-initiated discontinuation. Provider-initiated ART discontinuation patients were more likely to have a nadir CD4 ≥200 cells per cubic millimeter. Non–provider-initiated ART discontinuation patients were more likely to have unmet need for supportive services and to have not received HIV care in the past 3 months. Among all patients who discontinued, younger age, female gender, not having continuous health insurance, incarceration, injection drug use, nadir CD4 count ≥200 cells per cubic millimeter, unmet need for supportive services, no care in the past 3 months and HIV diagnosis ≥5 years before interview were independently associated with ART discontinuation.

Conclusions—These findings inform development of interventions to increase ART persistence by identifying groups at increased risk of ART discontinuation. Evidence-based interventions targeting vulnerable populations are needed and are increasingly important as recent HIV treatment guidelines have recommended universal ART.

Keywords

HIV/AIDS; antiretroviral therapy; discontinuation; HIV care

Correspondence to: Alison J. Hughes, MPH, San Francisco Department of Public Health, 25 Van Ness Avenue, Suite 500, San Francisco, CA 94102 (alison.hughes@sfdph.org).

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INTRODUCTION

Combination antiretroviral therapy (ART) provides a range of benefits to HIV-infected patients such as increased survival, improved immune status and decreased morbidity, and opportunistic infections.[1–5] Through viral suppression, ART reduces the likelihood of sexual transmission of HIV to uninfected partners.[6–9] Recognition of these benefits has led to recent treatment guideline changes to recommend ART for all HIV-infected patients regardless of immune status.[10] A major challenge of ART is that treatment must be continuous to receive benefits and in most cases requires a lifelong commitment.[10] Many factors can affect a patient's ability to sustain treatment and may lead to ART discontinuation.

Treatment interruptions can be planned or unplanned, short or long term, or permanent. The decision to discontinue ART can be made by the patient or by the provider. Some reasons providers may recommend discontinuing treatment include severe drug toxicity, intervening illness, surgery that precludes oral therapy, or unavailability of antiretroviral medication.[11] Patients may also choose to discontinue treatment due to factors such as personal beliefs (patient feels healthy and does not see the need to be on ART any longer), structural barriers (incarceration or transportation difficulties), or financial limitations or insurance status (loss of employment or insurance).

Although some therapy interruptions are clinically indicated, the negative effects of therapy discontinuation are well documented, with studies reporting that premature ART discontinuation results in decreased survival, lower CD4 count, increased viremia, and increased drug resistance.[12–16] Moreover, sexual transmission of HIV has been documented in patients who discontinued ART regimens.[17]

Previous research on ART utilization has focused primarily on adherence.[18–21] Examinations of the prevalence and predictors of ART discontinuation have demonstrated that certain patients are more likely to discontinue ART. Substance use,[22] injection drug use,[23] disease severity,[14,22,24,25] younger age,[14,25,26] racial/ethnic minorities,[26,27] female gender,[22,28] unemployment,[28] perceived HIV stigma,[29] fear of discrimination,[30] mental health,[14,24,28,31,32] and side effects[33] have been associated with ART discontinuation. However, these studies lack generalizability since they were conducted on subpopulations of HIV-infected patients, such as patients from 1 or a small group of clinics or hospitals, women only, or patients with a history of substance abuse. There are no population-based estimates of ART discontinuation nor has the distinction between provider-initiated and non–provider-initiated ART discontinuation been examined in previous literature. ART discontinuation and its effects will become an increasingly important issue as patients and providers come to adopt current universal treatment guidelines and the treatment eligible population increases. This analysis aims to estimate the weighted prevalence of ART initiation, current ART use and discontinuation, and to describe the main reason for discontinuation among a representative sample of HIV-infected adults receiving HIV care in the United States. In addition, we examined differences in the characteristics of patients who discontinued ART per provider recommendation versus those who self-initiated

discontinuation or discontinued due to structural barriers. Finally, we investigated predictors of ART discontinuation. These findings can inform the development and evaluation of interventions to increase ART persistence among populations who are at increased risk of self-initiated ART discontinuation.

METHODS

The Medical Monitoring Project (MMP) is a supplemental HIV surveillance system that uses a 3-stage sampling design to obtain nationally representative, annual, cross-sectional samples of HIV-infected adults receiving medical care for HIV in the United States to monitor clinical and behavioral outcomes.[33–35] States and territories are sampled first, then outpatient facilities providing HIV care in these areas, and finally adults aged 18 years or older receiving at least 1 medical care visit in the sampled facilities between January and April each year are selected. For this analysis, we used data from the 2009 MMP data collection cycle, which were collected through face-to-face interviews with sampled patients and a linked medical record abstraction between June 2009 and May 2010. Factors associated with facility and patient nonresponse were determined by conducting a nonresponse bias analysis using data collected on sampled facilities and patients. Data were weighted on the basis of known probabilities of selection at state or territory, facility, and patient levels. At the patient level, data were weighted to adjust for nonresponse by using predictors of patient-level response, including facility size, race/ethnicity, time since HIV diagnosis, and age group. The Center for Disease Control and Prevention's National Center for HIV, Viral Hepatitis, STD and TB Prevention has determined that MMP is a public health surveillance activity used for disease control program or policy purposes.[36] Because National Center for HIV, Viral Hepatitis, STD and TB Prevention determined that MMP is not research, it is not subject to human subjects regulations including federal investigational review board.[37] However, several participating states, territories, and facilities obtained local Investigational Review Board approval to conduct MMP.

Measures

Outcome Variable—ART use was ascertained by self-report. Patients were asked if they had ever taken antiretroviral medicines for their HIV. Patients who answered "yes" were classified as ever initiating ART. Additionally, patients were asked if they were currently taking any antiretroviral medicines for HIV at the time of the interview; if they answered "yes" they were defined as current ART-users. ART discontinuation was defined as patients who reported ever initiating ART but were not currently taking ART. Participants were also asked "What is the main reason you aren't currently taking any antiretroviral medicines?" Self-reported main reason for ART discontinuation was grouped into the following categories: (1) physician-advised treatment discontinuation, (2) individual/personal reasons, (3) therapy-related reasons, and (4) structural barriers to continuation. Examples of individual/personal reasons included felt healthy or CD4 and viral load values were good, depressed or overwhelmed, did not want to think about being HIV-positive, drinking or using drugs, or self-perceived therapy-related reasons such as worried about long-term effects of medication. Therapy-related examples included side effects of ART, difficulty swallowing pills, or allergic reactions to medications. Structural barriers included

incarceration, money or insurance issues, and difficulty obtaining an appointment at or transportation to a doctor's office. We created a separate variable that distinguished who initiated ART discontinuation by grouping patients into the following categories: provider-initiated ART discontinuation and non–provider-initiated ART discontinuation. Provider-initiated ART discontinuation included all patients who reported that they discontinued because their physician advised treatment discontinuation. Non–provider-initiated ART discontinuation included patients who discontinued for individual/personal reasons, self-perceived therapy-related reasons, and structural barriers.

Covariates—Sociodemographic variables (age, gender, sexual orientation, race/ethnicity, income, and education) were self-reported during the interview. Patients reported health insurance coverage, incarceration, homelessness, time since HIV diagnosis and alcohol and substance use during the previous 12 months. An 8-item Patient Health Questionnaire depression scale (PHQ-8) diagnostic algorithm was used to ascertain any major or other depression.[38] A dichotomous variable for unmet need for supportive services was created and defined as needing but not receiving any of the following services: adherence support, food/meals, AIDS Drug Assistance Program, public benefits such as Supplemental Security Income or Social Security Disability Insurance, transportation, mental health care, substance abuse, and/or HIV case management. No receipt of care in the past 3 months was calculated from self-reported month and year of most recent HIV medical appointment at any care facility. A binary outcome of inadequate health literacy based on self-report was defined as needing help reading hospital forms always, most of the time, about half the time or rarely versus never needing help.[39] Most recent viral load value, nadir CD4, and geometric mean CD4 count (the mean of all CD4 counts recorded during the past 12 months) were determined from data in the medical record. Viral suppression was defined as having HIV-1 RNA that was undetectable or <400 copies per milliliter at the most recent measurement in the past 12 months.

Data Analysis

Weighted univariate frequencies were calculated to estimate the prevalence and 95% confidence intervals for ART use among US patients receiving HIV care during January through April 2009. Weighted modified Rao–Scott χ^2 examined differences in sociodemographics, behavioral and clinical characteristics among patients who discontinued ART versus current ART-users. Weighted univariate frequencies described main reason for ART discontinuation. We calculated weighted modified Rao–Scott χ^2 to compare patient characteristics of provider-initiated and non–provider-initiated ART discontinuation. Finally, we performed weighted bivariate and multivariable logistic regression analyses to identify factors associated with all ART discontinuation and built separate models stratified by provider-initiated and non–provider-initiated ART discontinuation. Given limited literature on predictors of ART discontinuation, we applied an empirical approach to our model selection strategy. Weighted multivariable models were built according to a backward elimination strategy that initially included all variables associated with ART discontinuation at $P \leq 0.10$ and retained variables that remained significant at $P \leq 0.05$. All analyses accounted for the complex sampling design and selection probabilities and were conducted using SAS version 9.2 (SAS Institute, Cary, NC).

RESULTS

All sampled states and territories participated in MMP [California (including the separately funded jurisdictions of Los Angeles County and San Francisco), Delaware, Florida, Georgia, Illinois (including Chicago), Indiana, Michigan, Mississippi, New Jersey, New York (including New York City), North Carolina, Oregon, Pennsylvania (including Philadelphia), Puerto Rico, Texas (including Houston), Virginia, and Washington]. Within these areas, 603 HIV care facilities were sampled and of these, 461 participated in MMP (facility response rate = 76%). Of the 9338 persons sampled from the participating facilities, 4217 completed both an interview and a linked medical record abstraction (adjusted patient-level response rate = 51%) for a combined response rate of 39%. After weighting for probability of selection and nonresponse, these 4217 participants were estimated to represent a population of 421,186 HIV-infected adults receiving medical care in the United States between January and April 2009.

Antiretroviral Therapy Use

An estimated 93% of adults receiving HIV care in the United States ever initiated ART. The majority of these ART initiators were currently taking ART (94%) and 6% or an estimated 21,769 persons discontinued ART (Table 1).

Sociodemographic Characteristics Associated With ART Discontinuation

Overall, the majority of the population was male, self-identified as heterosexual or straight, had some college education or more, had an income above the poverty level and had insurance for the entire previous 12 months (Table 2).

There were significant sociodemographic differences between the population reporting ART discontinuation compared with those reporting current ART use. Compared with current ART-users, those who discontinued ART were younger, more likely to be female and less likely to identify as homosexual. More African Americans and mixed or other race/ethnicities discontinued ART. Those who discontinued ART were less likely to have insurance for the entire previous 12 months and were more likely to have been incarcerated and homeless in the previous 12 months.

Behavioral, Clinical, and Other Characteristics Associated With ART Discontinuation

Compared with the population of current ART-users, those who discontinued were significantly more likely to use injection drugs, non–injection drugs and stimulants in the past 12 months (Table 3). ART discontinuation patients were more likely to have major or other depression in the past 12 months compared with current ART-users. ART discontinuation patients were significantly more likely to have a higher nadir CD4 count ($\geq$200 cells/mm^3) and a detectable viral load than current ART-users. Finally, ART discontinuation patients were more likely to have an unmet need for supportive services in the past 12 months and to have not received care in the last 3 months.

Main Reason for ART Discontinuation

The most common reported reason for ART discontinuation was a doctor's advice to delay or stop treatment (51%). Other reasons for discontinuation included individual/personal reasons (16%), therapy-related concerns (20%), structural barriers (12%), or another or unknown reason (2%).

Comparison of Provider-Initiated Versus Non–Provider-Initiated ART Discontinuation

Given that half of the ART discontinuation population discontinued on the recommendation of their doctor, we stratified ART discontinuation patients into 2 subpopulations based on who initiated ART discontinuation to examine differences in sociodemographic and other characteristics (Table 4). Patients who discontinued ART due to provider recommendation were significantly more likely to have a nadir CD4 ≥200 cells per cubic millimeter compared with those who initiated discontinuation themselves or discontinued due to structural barriers. Non–provider-initiated ART discontinuation patients were significantly more likely to have unmet needs for supportive services and to have not received care in the past 3 months. No other significant differences between provider-initiated and non–provider-initiated ART discontinuation patients were found.

Predictors of ART Discontinuation

Among all patients who discontinued, younger age, female gender, not having continuous health insurance, incarceration, injection drug use, nadir CD4 count ≥200 cells per cubic millimeter, unmet need for supportive services, no receipt of care in the past 3 months, and HIV diagnosis ≥5 years before interview were independently associated with ART discontinuation (Table 5). For patients who discontinued ART due to provider recommendation, younger age, female gender, heterosexual and bisexual self-identified sexual orientation (compared with homosexual), stimulant use, nadir CD4 count ≥200 cells per cubic millimeter, and HIV diagnosis ≥10 years before interview were associated with higher odds of discontinuing ART. Among patients who had non–provider-initiated ART discontinuation, female gender, not having continuous health insurance over the past 12 months, injection drug use, non–injection drug use, unmet need for supportive services in the past 12 months, and patients who did not receive care in the past 3 months had greater odds of discontinuing ART.

DISCUSSION

Approximately 1 of every 20 adults receiving HIV care in the United States who initiated ART discontinued treatment. We believe this is the first representative estimate of ART discontinuation among adults receiving HIV care in the United States.

Aside from some clinically necessary interruptions, successful HIV management requires lifelong ART adherence once treatment is initiated.[10] Among our study population, half of the patients who discontinued ART did so based on their provider's recommendation and the other half discontinued at their own initiative or due to a structural barrier. We, therefore, explored potential population differences between non–provider-initiated and provider-initiated ART discontinuation and found that patients with nadir CD4 ≥200 cells per cubic

millimeter had higher odds of provider-initiated ART discontinuation. This finding likely reflects the treatment recommendations in place between June 2009 and May 2010 when these data were collected. In 2009, treatment guidelines strongly recommended ART for patients with a CD4 count <350 cells per cubic millimeter and recommended ART for patients with a CD4 count between 350 and 500 cells per cubic millimeter.[40] Therefore, the patients in our analysis who discontinued ART on their provider's recommendation may have been advised to do so because a previously low CD4 count improved or if they presented to a health care provider for the first time with a CD4 count ≥350 cells per cubic millimeter. We found no evidence that providers were recommending ART discontinuation based on patient characteristics such as homelessness or injection drug use.[41,42]

Similar to previous studies, we found that younger patients were more likely to discontinue ART.[14,25,26] Young age was also significant for provider-initiated ART discontinuation. Younger HIV-positive patients have also been shown to have lower ART adherence (which may be understood as a brief ART discontinuation) compared with older patients possibly because of more frequent substance use, lack of experience managing illnesses, lack of perceived treatment benefits, lower self-efficacy, and lack of perceived threat of illness.[43,44] We also found that women were more likely to discontinue ART in all 3 models, consistent with other studies on ART persistence.[22,28] More frequent HIV medication side effects and toxicity reported by women compared with men[45,46] may account for the lower ART persistence observed in women. We found that injection drug use in the past 12 months was associated with significantly increased odds of discontinuing ART, which is consistent with other studies.[47–49] This was true among all patients and among non–provider-initiated discontinuation. Additionally, incarceration in the past 12 months was also associated with ART discontinuation.[48,49]

We observed that higher immune status, as indicated by nadir CD4 ≥200 cells per cubic millimeter, was associated with overall ART discontinuation and provider-initiated ART discontinuation, which to the best of our knowledge has not been described in previous studies. Although not a significant predictor in our final model of non–provider-initiated ART discontinuation, some patients with a high nadir CD4 self-initiated ART discontinuation (n = 60; Table 4). One possible explanation for this finding may be that healthier individuals may not feel there are benefits to their health by continuing with ART. Gao et al[50] found that severely ill HIV-positive patients were more likely to perceive a higher risk of complications if they did not adhere to treatment compared with asymptomatic HIV-positive patients and found that those with higher immune status were significantly less adherent to their ART regimen than patients with poorer immune status.

Unmet need for any supportive service was also associated with nonprovider ART discontinuation, which is not unexpected, given that many supportive services aim to help HIV-positive individuals effectively manage their disease and adhere to care visits and treatment. Although there is no previous research showing an effect of supportive services on consistent ART use, Kushel et al[51] found that case management improved ART adherence and severely food-insecure patients have been found to have significantly poorer ART adherence and viral suppression.[52,53] Receipt of 6 or more mental health care visits in

the past year among patients with a psychiatric diagnosis has also been associated with increased ART persistence.[32]

Unlike several previous studies,[26,27] we did not find independent racial/ethnic disparities in ART discontinuation. African Americans in our analysis were disproportionately younger, female and incarcerated, factors significant in our overall multivariate model. We also did not find an independent association between depression and ART discontinuation contrary to what has been previously reported.[14,24,28,31,54] HIV-positive women are more likely to be depressed than HIV-positive men,[55] which may explain why depression is no longer associated with ART discontinuation when we controlled for gender in our final model. Additionally, depression has been shown to decrease HIV care retention[56]; patients experiencing depression and who are not in care are less likely to be captured by MMP. Finally, our depression measure only captures patients who are currently experiencing depressive symptoms and not treatment of depression, so patients who are currently being treated for depression may not be captured by this measure.

This analysis is subject to several limitations. ART discontinuation was self-reported and information regarding how long the patient was taking ART before discontinuing and when the discontinuation occurred was not recorded in the interview. This could not be verified from medical records because only the prescription for ART is documented in the medical record, not if the medication was actually taken by the patient. Specific regimens of ART were not evaluated in our analysis and ART adherence could be affected by the tolerability, pill burden, and other factors such as the convenience of administration of the ART regimen taken.[23] Our measure of ART discontinuation covers current ART use; those who are classified as current ART-users could have had periods of ART discontinuation in the past that we could not measure. Additionally, MMP samples people receiving HIV care in the United States and does not include people who discontinue ART after dropping out of care. As a result, our estimate likely underestimates the proportion of ART discontinuation in the entire population of people living with HIV. Similarly, limiting the data collection to people receiving HIV care in the United States has implications for generalizability to the entire population of HIV-infected individuals including those who have dropped out of care or have never been in care. Furthermore, because this is a cross-sectional observational analysis, we were able to assess associations with ART discontinuation but causality and temporality cannot be determined.

Many of the measures used in this analysis were self-reported and subject to recall and social-desirability bias. If patients were less likely to report stigmatized information such as ART discontinuation, incarceration, and injection drug use, such underreporting could result in an underestimation of the association between ART discontinuation and injection drug use and incarceration. However, interviewers were trained by CDC staff to conduct the interview in an impartial manner to minimize social-desirability bias and used standardized response cards (calendars, pictures of HIV medications, and others) to assist in patient recall. Although ART discontinuation was self-reported, we evaluated the validity of self-report by looking at most recent viral load from the medical record, and the majority (83%) of patients who reported discontinuation had a detectable viral load according to their most recent test result.

Despite these limitations, the probability sampling design and the fact that data were weighted to represent the entire population of adults receiving HIV care in the United States from January to April 2009 are major strengths of this study. As such, this analysis provides valuable information about factors associated with ART discontinuation and reasons for discontinuation. Looking at ART discontinuation in a care context where there is the potential to intervene and ensure ART adherence is valuable, particularly as the most recent treatment guidelines now recommend universal HIV treatment regardless of immune status.[10] Efforts to understand patterns of treatment discontinuation, personal health beliefs (not measured in this analysis), and behaviors that could affect persistence will become increasingly important to evaluate which populations are at risk of not maintaining lifelong treatment. Developing and evaluating targeted interventions and providing supportive services toward populations vulnerable to ART discontinuation are needed because such interventions and support might reduce disparities in HIV treatment, which will ultimately contribute to a reduction in HIV transmission and improvements in the health of HIV-infected patients.

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TABLE 1

ART Use Among US Adults Receiving HIV Care—MMP, 2009

	Sample, n/N	Weighted, n/N	Weighted, %	95% CI for Weighted, %
Total	4217/4217	421,186/421,186	100	
Ever initiated ART	3931/4217	392,762/421,186	93.3	92.2 to 94.3
Current ART use	3708/3926	370,367/392,136	94.4	93.7 to 95.2
ART discontinuation	218/3926	21,769/392,136	5.6	4.8 to 6.3

CI, confidence interval.

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TABLE 2

Sociodemographic Characteristics of US Adults Receiving HIV Care Who Reported ART Initiation Stratified by ART Discontinuation and Current ART Use—MMP, 2009

	Total			ART Discontinuation			Current ART Use			
Characteristic	**Sample, n**	**Weighted, %**	**95% CI for Weighted, %**	**Sample, n**	**Weighted, %**	**95% CI for Weighted, %**	**Sample, n**	**Weighted, %**	**95% CI for Weighted, %**	***P****
Total	3926	100.0		218	100.0		3708	100.0		
Age in years										<0.01
18–29	259	6.3	5.3 to 7.2	30	13.3	9.4 to 17.2	229	5.8	4.9 to 6.8	
30–39	654	16.7	14.8 to 18.5	55	24.3	17.0 to 31.5	599	16.2	14.5 to 18.0	
40–49	1561	40.1	38.1 to 42.1	93	43.7	35.9 to 51.5	1468	39.9	37.9 to 41.8	
≥50	1452	37.0	35.0 to 38.9	40	18.7	12.8 to 24.7	1412	38.1	36.1 to 40.0	
Gender										<0.01
Male	2831	72.9	69.7 to 76.1	117	52.7	45.6 to 59.9	2714	74.1	71.0 to 77.2	
Female	1035	27.1	23.9 to 30.3	97	47.3	40.1 to 54.4	938	25.9	22.8 to 29.0	
Sexual orientation										<0.01
Homosexual	1599	41.9	37.0 to 46.7	68	30.2	23.3 to 37.1	1531	42.6	37.7 to 47.4	
Heterosexual	1955	50.2	45.3 to 55.1	127	59.5	52.3 to 66.8	1828	49.6	44.8 to 54.5	
Bisexual	311	7.9	7.1 to 8.8	20	10.3	6.2 to 14.4	291	7.8	6.9 to 8.7	
Race/ethnicity										0.01
White	1337	35.7	29.0 to 42.3	63	30.5	21.8 to 39.2	1274	36.0	29.3 to 42.6	
African American	1579	40.3	32.2 to 48.4	111	49.4	40.0 to 58.7	1468	40.0	31.6 to 47.9	
Latino	824	19.2	14.2 to 24.2	30	12.3	8.3 to 16.3	794	19.6	14.4 to 24.9	
Mixed/other	186	4.8	3.8 to 5.8	14	7.8	3.5 to 12.2	172	4.6	3.7 to 5.5	
Education										0.40
Less than high school	925	22.9	20.3 to 25.6	64	26.4	19.5 to 33.2	861	22.7	20.1 to 25.4	
High school graduate	1074	26.7	23.9 to 29.5	57	27.6	20.1 to 35.0	1017	26.7	24.0 to 29.4	
Some college or more	1926	50.3	45.4 to 55.2	96	46.0	36.9 to 55.2	1830	50.6	45.8 to 55.4	
Income										0.22

Characteristic	Total			ART Discontinuation			Current ART Use			
	Sample, n	Weighted, %	95% CI for Weighted, %	Sample, n	Weighted, %	95% CI for Weighted, %	Sample, n	Weighted, %	95% CI for Weighted, %	*P**
Above poverty level	2085	57.2	53.0 to 61.4	96	52.1	42.0 to 62.2	1989	57.5	53.4 to 61.6	
At or below poverty level	1681	42.8	38.6 to 47.0	103	47.9	37.8 to 58.0	1578	42.5	38.4 to 46.7	
Health insurance status										0.02
Insured entire past 12 mo	2986	76.4	72.2 to 80.7	146	67.5	59.9 to 75.0	2840	77.0	72.8 to 81.2	
Uninsured part of the past 12 mo	394	9.7	8.2 to 11.1	31	14.3	9.0 to 19.7	363	9.4	7.9 to 10.9	
Uninsured entire past 12 mo	536	13.9	10.5 to 17.3	40	18.2	11.6 to 24.8	496	13.7	10.3 to 17.0	
Incarceration in past 12 mo	206	5.4	4.3 to 6.4	26	11.2	7.7 to 14.6	180	5.0	3.9 to 6.1	<0.01
Homeless in past 12 mo	343	8.5	7.3 to 9.8	29	13.2	8.9 to 17.5	314	8.3	7.0 to 9.5	0.02

*Rao–Scott χ^2 for ART discontinuation versus current ART use.

CI, confidence interval.

TABLE 3

Behavioral, Clinical, and Other Characteristics of US Adults Receiving HIV Care Who Reported ART Initiation Stratified by ART Discontinuation and Current ART Use—MMP, 2009

	Total			ART Discontinuation			Current ART Use			
Characteristic	**Sample, n**	**Weighted, %**	**95% CI for Weighted %**	**Sample, n**	**Weighted, %**	**95% CI for Weighted, %**	**Sample, n**	**Weighted, %**	**95% CI for Weighted %**	***P****
Total	3926	100.0		218	100.0		3708	100.0		
Time since HIV diagnosis in years										0.14
<5	791	20.6	18.8 to 22.3	36	16.1	11.9 to 20.3	755	20.8	19.0 to 22.7	
5–9	923	23.4	21.6 to 25.2	48	22.7	17.2 to 28.1	875	23.4	21.5 to 25.4	
≥10	2210	56.0	53.6 to 58.5	134	61.2	55.1 to 67.3	2076	55.7	53.3 to 58.2	
Binge drinking	655	16.0	14.6 to 17.4	42	19.5	14.5 to 24.5	613	15.8	14.3 to 17.2	0.14
Injection drug use past 12 mo	86	2.0	1.1 to 2.8	16	6.5	2.9 to 10.2	70	1.7	0.9 to 2.5	<0.01
Non–injection drug use past 12 mo†	558	13.9	12.1 to 15.8	44	19.0	13.6 to 24.3	514	13.7	11.8 to 15.5	0.07
Stimulant past 12 mo	419	10.2	8.6 to 11.8	41	17.4	12.1 to 22.6	378	9.8	8.2 to 11.4	<0.01
Any major or other depression	948	25.1	23.3 to 26.9	74	33.4	27.2 to 39.7	874	24.6	22.7 to 26.5	0.01
Geometric mean CD4 count past 12 mo										<0.01
0–199 cells/mm^3	530	13.0	11.5 to 14.5	32	15.3	9.7 to 20.8	498	12.9	11.4 to 14.4	
200–499 cells/mm^3	1642	43.3	41.6 to 45.1	90	43.5	36.9 to 50.1	1552	43.3	41.5 to 45.1	
≥500 cells/mm^3	1624	43.7	41.7 to 45.6	81	41.2	33.2 to 49.3	1543	43.8	41.8 to 45.8	
Nadir CD4										<0.01
0–199 cells/mm^3	1977	49.2	46.5 to 51.8	67	30.0	21.1 to 39.0	1910	50.3	47.8 to 52.8	
200–349 cells/mm^3	1052	27.2	25.6 to 28.9	62	28.0	22.3 to 33.8	990	27.2	25.6 to 28.8	
350–499 cells/mm^3	476	12.8	11.6 to 14.0	39	16.9	10.9 to 22.9	437	12.6	11.3 to 13.8	
≥500 cells/mm^3	393	10.8	8.8 to 12.8	49	25.1	16.5 to 33.6	344	10.0	8.1 to 11.8	
Most recent viral load‡										<0.01
Undetectable	2964	79.4	76.8 to 82.0	32	17.1	12.2 to 21.9	2932	82.8	80.3 to 85.3	
Detectable	778	20.6	18.0 to 23.2	163	82.9	78.1 to 87.8	615	17.2	14.7 to 19.7	

Characteristic	Total			ART Discontinuation			Current ART Use			*P**
	Sample, n	Weighted, %	95% CI for Weighted %	Sample, n	Weighted, %	95% CI for Weighted, %	Sample, n	Weighted, %	95% CI for Weighted %	
Unmet need for supportive services, past 12 mo§	1171	30.6	28.6 to 32.6	109	48.9	41.9 to 55.9	1062	29.5	27.6 to 31.4	<0.01
Inadequate health literacy	1441	36.5	33.7 to 39.3	75	32.3	25.9 to 38.7	1366	36.8	33.9 to 39.6	0.23
No care past 3 mo	761	19.8	17.5 to 22.2	55	27.1	20.1 to 34.2	706	19.4	17.0 to 21.8	0.04

*Rao–Scott χ^2 for ART discontinuation versus current ART use.

†Excludes patients who reported using marijuana only in past 12 months.

‡Most recent viral load from medical chart abstraction. Undetectable defined as result of “undetectable” or less than 400 copies per milliliter.

§Adherence support, food/meals, ADAP, public benefits, transportation, mental health care, substance abuse, and HIV case management.

CI, confidence interval.

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TABLE 4

Comparison of Sociodemographic and Other Factors Between Provider-Initiated and Non–Provider-Initiated ART Discontinuation Patients—MMP, 2009

	Provider-Initiated ART Discontinuation		Non–Provider-Initiated ART Discontinuation		
	Sample, n	Weighted, %	Sample, n	Weighted, %	*P*
Total	108	100	104	100	
Age in years					0.08
18–29	20	18.4	10	8.4	
30–39	28	24.6	25	23.8	
40–49	43	41.7	46	44.7	
≥50	17	15.3	23	23.1	
Gender					0.12
Male	52	47.9	62	58.2	
Female	54	52.1	40	41.8	
Sexual orientation *					0.07
Homosexual	29	25.5	39	36.5	
Heterosexual	71	66.2	51	51.4	
Bisexual	7	8.3	12	12.2	
Race/ethnicity					0.46
White	29	30.0	33	37.3	
African American	62	58.1	46	48.8	
Latino	13	11.9	15	14.0	
Continuous health insurance, past 12 mo					0.43
Yes	73	70.6	71	65.0	
No	34	29.4	33	35.0	
Incarceration in past 12 mo					0.40
No	98	91.2	90	87.6	
Yes	10	8.8	14	12.4	
Homeless in past 12 mo *					0.87
No	96	88.2	90	87.3	
Yes	12	11.8	14	12.7	

	Provider-Initiated ART Discontinuation		Non–Provider-Initiated ART Discontinuation		
	Sample, n	Weighted, %	Sample, n	Weighted, %	*P*
Injection drug use past 12 mo *					0.09
No	104	96.4	93	90.6	
Yes	4	3.6	11	9.4	
Stimulant past 12 mo					0.61
No	89	84.2	84	81.6	
Yes	19	15.8	20	18.4	
Any major or other depression					0.89
No	72	66.9	66	65.7	
Yes	36	33.1	37	34.3	
Nadir CD4					<0.01
0–199 cells/mm^3	17	15.1	44	43.0	
≥200 cells/mm^3	90	84.9	60	57.0	
Unmet need for supportive services, past 12 mo †					0.02
No	62	60.8	42	42.3	
Yes	43	39.2	62	57.7	
HIV care not received in past 3 mo					<0.01
No	89	83.4	67	60.6	
Yes	19	16.6	36	39.4	
Time since HIV diagnosis in years					0.27
<5	22	19.3	13	12.6	
5–9	20	20.3	28	26.1	
≥10	66	60.5	63	61.3	

* Estimates may be unstable due to small cell count, interpret weighted percent with caution.

† Adherence support, food/meals, ADAP, public benefits, transportation, mental health care, substance abuse, and HIV case management.

TABLE 5

Adjusted Odds Ratios and 95% CIs Between 3 ART Discontinuation Outcomes (All ART Discontinuation, Provider-Initiated ART Discontinuation, and Non–Provider-Initiated ART Discontinuation) and Sociodemographics, Behavioral Risk, and Clinical Factors Among US Patients Receiving HIV Care Who Reported ART Initiation—MMP, 2009

	All ART Discontinuation			Provider-Initiated ART Discontinuation			Non–Provider-Initiated ART Discontinuation		
	AOR	95% CI	*P*	AOR	95% CI	*P*	AOR	95% CI	*P*
Age in years			<0.01			<0.01			
18–29	5.2	2.9 to 9.4		9.5	4.8 to 18.8				
30–39	3.0	1.8 to 4.9		4.8	2.6 to 8.7				
40–49	2.0	1.3 to 3.2		2.6	1.4 to 4.8				
≥50	1.0	Ref		1.0	Ref				
Gender			<0.01			<0.01			<0.01
Male	1.0	Ref		1.0	Ref		1.0	Ref	
Female	2.3	1.8 to 3.0		2.1	1.3 to 3.4		2.3	1.5 to 3.5	
Sexual orientation						0.02			
Homosexual				1.0	Ref				
Heterosexual				1.9	1.0 to 3.6				
Bisexual				2.3	1.3 to 4.1				
Continuous health insurance, past 12 mo			0.02						0.02
Yes	1.0	Ref					1.0	Ref	
No	1.5	1.1 to 2.1					1.8	1.1 to 2.8	
Incarceration in past 12 mo			<0.01						
No	1.0	Ref							
Yes	2.0	1.3 to 3.0							
Injection drug use past 12 mo			<0.01						<0.01
No	1.0	Ref					1.0	Ref	
Yes	4.5	2.4 to 8.6					4.4	2.3 to 8.3	
Stimulant use past 12 mo						<0.01			
No				1.0	Ref				
Yes				2.3	1.4 to 3.9				<0.01

	All ART Discontinuation			Provider-Initiated ART Discontinuation			Non–Provider-Initiated ART Discontinuation		
	AOR	**95% CI**	***P***	**AOR**	**95% CI**	***P***	**AOR**	**95% CI**	***P***
Non–injection drug use past 12 mo							1.0	Ref	
No							1.8	1.2 to 2.7	
Yes									
Nadir CD4			<0.01			<0.01			
0–199 cells/mm^3	1.0	Ref		1.0	Ref				
200–349 cells/mm^3	1.9	1.2 to 2.8		2.8	1.6 to 4.9				
350–499 cells/mm^3	2.2	1.2 to 4.1		6.6	3.3 to 13.5				
≥500 cells/mm^3	4.4	2.6 to 7.6		15.5	7.6 to 31.7				
Unmet need for supportive services, past 12 mo *			<0.01						<0.01
No	1.0	Ref					1.0	Ref	
Yes	1.9	1.4 to 2.5					2.1	1.4 to 3.1	
No care past 3 mo			0.03						<0.01
No	1.0	Ref					1.0	Ref	
Yes	1.5	1.0 to 2.2					2.7	1.6 to 4.6	
Time since HIV diagnosis in years			<0.01			<0.01			
<5	1.0	Ref		1.0	Ref				
5–9	1.7	1.0 to 2.8		1.2	0.7 to 2.0				
≥10	2.9	2.0 to 4.4		2.2	1.5 to 3.3				

*Adherence support, food/meals, ADAP, public benefits, transportation, mental health care, substance abuse, and HIV case management.

CI, confidence interval; AOR, adjusted odds ratio.